Claims

What is claimed is:

1. An electrode plate for a battery, comprising:

a carbon foam current collector including a network of pores, and

a chemically active paste disposed on the carbon foam current collector such that the chemically active paste penetrates into the network of pores.

2. The electrode plate of claim 1, wherein the chemically active paste includes at least one of an oxide of lead, nickel hydroxide, cadmium hydroxide, lanthanum nickel, zinc hydroxide, and iron hydroxide.

3. The electrode plate of claim 1, wherein the carbon foam current collector has a total porosity value of at least 60%.

4. The electrode plate of claim 1, wherein the carbon foam current collector has an open porosity value of at least 90%.

5. The electrode plate of claim 1, wherein the carbon foam current collector has an electrical resistivity value of less than about 1 Ω-cm.

6. The electrode plate of claim 1, wherein the carbon foam current collector comprises graphite foam.

7. The electrode plate of claim 6, wherein the graphite foam current collector has an electrical resistivity value of between about 100 μΩ-cm and about 2500 μΩ-cm.

8. The electrode plate of claim 1, wherein the carbon foam current collector has a density of less than about 0.6 g/cm^3.

9. The electrode plate of claim 1, wherein the carbon foam current collector has an average pore size of at least about 200 μm.

10. The electrode plate of claim 1, wherein the carbon foam current collector has an average pore size of at least about 40 μm.

11. The electrode plate of claim 1, wherein the carbon foam current collector has an average pore size of at least about 20 μm.

12. The electrode plate of claim 1, wherein the carbon foam current collector comprises carbonized wood.

13. The electrode plate of claim 1, wherein the carbon foam current collector comprises graphitized wood.

14. A method of making an electrode plate for a battery comprising:

supplying a wood substrate;

carbonizing the wood substrate to form a carbonized wood current collector; and

disposing a chemically active material on the carbonized wood current collector.

15. The method of claim 14, wherein the carbonized wood current collector comprises a network of pores, and the chemically active material penetrates at least a portion of the network of pores.

16. The method of claim 14, wherein the carbonizing comprises heating the wood substrate, in a substantially inert environment, to a temperature of between about 800 °C and about 1400 °C for a time sufficient to convert at least a portion of the wood substrate to a carbon matrix.

17. The method of claim 16, further comprising:

graphitizing the wood substrate by heating the wood substrate to a temperature of between about 2400 °C and about 3000 °C for a time sufficient to convert at least a portion of the carbon matrix to a graphite matrix.

18. A method of making an electrode plate for a battery comprising:

forming a current collector from carbon foam, wherein the current collector includes a tab, and the carbon foam includes a network of pores;

forming an electrical connection at the tab of the current collector;

applying a chemically active material to the current collector such that the chemically active material penetrates the network of pores in the carbon foam.

19. The method of claim 18, wherein the step of forming the electrical connection further includes:

applying a first conductive material to the tab, and

applying a second conductive material to the first conductive material.

20. The method of claim 19, wherein the first conductive material includes silver and is applied to the tab in the form of a thermal spray.

21. The method of claim 19, wherein the second conductive material includes lead.

22. The method of claim 18, wherein the step of forming the current collector further includes machining the carbon foam using wire EDM.

23. The method of claim 18, wherein the carbon foam current collector has a total porosity value of at least 60 % and an open porosity value of at least 90 %.

24. The method of claim 18, wherein the carbon foam current collector has an electrical resistivity value of less than about 1 Ω-cm.

25. The method of claim 18, wherein the carbon foam current collector is graphite foam.

26. The method of claim 18, wherein the graphite foam current collector has an electrical resistivity value of between about 100 μΩ-cm and about 2500 μΩ-cm.

27. A battery comprising:

a housing;

a positive terminal and a negative terminal;

at least one cell disposed within the housing and including at least one positive plate and at least one negative plate connected to the positive terminal and negative terminal, respectively; and

an electrolytic solution filling a volume between the positive and negative plates;

wherein the at least one positive plate further includes

a carbon foam current collector including a network of pores, and

a chemically active material disposed on the carbon foam current collector such that the chemically active paste penetrates the network of pores.

28. The battery of claim 27, wherein the carbon foam current collector has a total porosity value of at least 60% and an open porosity value of at least 90%.

29. The battery of claim 27, wherein the carbon foam current collector has an electrical resistivity value of less than about 1 Ω-cm.

30. The battery of claim 27, wherein the carbon foam current collector includes graphite foam and has an electrical resistivity value of between about 100 μΩ-cm and about 2500 μΩ-cm.

31. The battery of claim 27, wherein the carbon foam current collector has a density of less than about 0.6 g/cm^3.

32. The battery of claim 27, wherein the at least one negative plate further includes a carbon foam current collector including a network of pores, and a chemically active material disposed on the carbon foam current collector of the negative plate such that the chemically active material penetrates the network of pores.

33. The battery of claim 27, wherein the chemically active material includes a paste comprising an oxide of lead.

34. The battery of claim 27, wherein the chemically active material includes at least one of nickel hydroxide, cadmium hydroxide, lanthanum nickel, zinc hydroxide, and iron hydroxide.

35. A battery comprising:

a housing;

a positive terminal and a negative terminal external to the housing;

a plurality of cells disposed between the positive terminal and the negative terminal;

a plurality of positive plates disposed in alternating series with a plurality of negative plates within each of the plurality of cells; and

an electrolytic solution disposed within the housing and filling a volume between adjacent pairs of positive and negative plates;

wherein both the plurality of positive plates and the plurality of negative plates further include carbon foam current collectors each including a network of pores, and a chemically active material disposed on the carbon foam current collectors such that the chemically active material penetrates the network of pores, and

wherein the carbon foam current collectors of both the positive and negative plates each include a tab of carbon foam coated with a conductive metal material configured to make electrical connections to the current collectors of both the positive and negative plates.